

## FEATURES

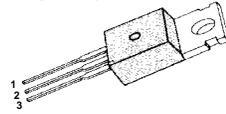
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- 175°C Operating Temperature
- Extended Safe Operating Area
- Lower Leakage Current : -10  $\mu$ A (Max.) @  $V_{DS} = -100V$
- Low  $R_{DS(ON)}$  : 0.444  $\Omega$  (Typ.)

$$BV_{DSS} = -100 \text{ V}$$

$$R_{DS(on)} = 0.6 \Omega$$

$$I_D = -6 \text{ A}$$

### TO-220



1.Gate 2. Drain 3. Source

## Absolute Maximum Ratings

| Symbol         | Characteristic  | Value        | Units            |
|----------------|---|--------------|------------------|
| $V_{DSS}$      | Drain-to-Source Voltage   | -100         | V                |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ\text{C}$ )                     | -6           | A                |
|                | Continuous Drain Current ( $T_C=100^\circ\text{C}$ )                    | -4           |                  |
| $I_{DM}$       | Drain Current-Pulsed ①  | -24          | A                |
| $V_{GS}$       | Gate-to-Source Voltage  | $\pm 30$     | V                |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②  | 144          | mJ               |
| $I_{AR}$       | Avalanche Current ①   | -6           | A                |
| $E_{AR}$       | Repetitive Avalanche Energy ①   | 4.9          | mJ               |
| dv/dt          | Peak Diode Recovery dv/dt ③   | -6.5         | V/ns             |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ\text{C}$ )                      | 49           | W                |
|                | Linear Derating Factor  | 0.33         |                  |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +175 | $^\circ\text{C}$ |
| $T_L$          | Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds | 300          |                  |

## Thermal Resistance

| Symbol          | Characteristic      | Typ. | Max. | Units              |
|-----------------|---------------------|------|------|--------------------|
| $R_{\theta JC}$ | Junction-to-Case    | --   | 3.06 | $^\circ\text{C/W}$ |
| $R_{\theta CS}$ | Case-to-Sink        | 0.5  | --   |                    |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 62.5 |                    |

### Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise specified)

| Symbol                 | Characteristic                          | Min. | Typ. | Max. | Units              | Test Condition   |
|------------------------|---|------|------|------|--------------------|--|
| $BV_{DSS}$             | Drain-Source Breakdown Voltage          | -100 | --   | --   | V                  | $V_{GS}=0V, I_D=-250\mu\text{A}$   |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | -0.1 | --   | $V/^\circ\text{C}$ | $I_D=-250\mu\text{A}$ <b>See Fig 7</b>                                       |
| $V_{GS(th)}$           | Gate Threshold Voltage                  | -2.0 | --   | -4.0 | V                  | $V_{DS}=-5V, I_D=-250\mu\text{A}$  |
| $I_{GSS}$              | Gate-Source Leakage , Forward           | --   | --   | -100 | nA                 | $V_{GS}=-20V$  |
|                        | Gate-Source Leakage , Reverse           | --   | --   | 100  |                    | $V_{GS}=20V$   |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | --   | --   | -10  | $\mu\text{A}$      | $V_{DS}=-100V$   |
|                        |   | --   | --   | -100 |                    | $V_{DS}=-80V, T_C=150^\circ\text{C}$   |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 0.6  | $\Omega$           | $V_{GS}=-10V, I_D=-3A$ ④   |
| $g_{fs}$               | Forward Transconductance                | --   | 3.6  | --   | S                  | $V_{DS}=-40V, I_D=-3A$ ④   |
| $C_{iss}$              | Input Capacitance                       | --   | 425  | 550  | pF                 | $V_{GS}=0V, V_{DS}=-25V, f=1\text{MHz}$<br><b>See Fig 5</b>                  |
| $C_{oss}$              | Output Capacitance                      | --   | 90   | 135  |                    |  |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 31   | 45   |                    |  |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 11   | 30   | ns                 | $V_{DD}=-50V, I_D=-6A,$<br>$R_G=18\Omega$<br><b>See Fig 13</b> ④⑤            |
| $t_r$                  | Rise Time                               | --   | 21   | 50   |                    |  |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 34   | 80   |                    |  |
| $t_f$                  | Fall Time                               | --   | 18   | 45   |                    |  |
| $Q_g$                  | Total Gate Charge                       | --   | 16   | 20   | nC                 | $V_{DS}=-80V, V_{GS}=-10V,$<br>$I_D=-6A$<br><b>See Fig 6 &amp; Fig 12</b> ④⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 3.1  | --   |                    |  |
| $Q_{gd}$               | Gate-Drain("Miller") Charge             | --   | 6.3  | --   |                    |  |

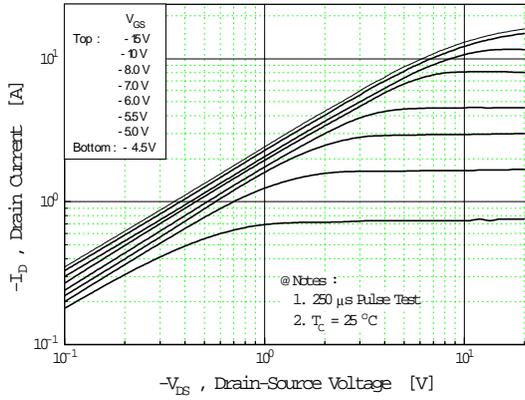
### Source-Drain Diode Ratings and Characteristics

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units         | Test Condition                             |
|----------|---------------------------|------|------|------|---------------|--|
| $I_S$    | Continuous Source Current | --   | --   | -6   | A             | Integral reverse pn-diode in the MOSFET    |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | -24  |               |  |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | -3.8 | V             | $T_J=25^\circ\text{C}, I_S=-6A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 105  | --   | ns            | $T_J=25^\circ\text{C}, I_F=-6A$            |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 0.4  | --   | $\mu\text{C}$ | $di/dt=100A/\mu\text{s}$ ④                 |

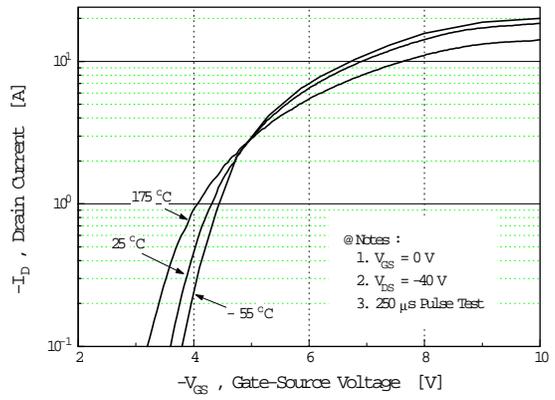
#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=6.0\text{mH}, I_{AS}=-6A, V_{DD}=-25V, R_G=27\Omega^*$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq -6A, di/dt \leq 350A/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width =  $250\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

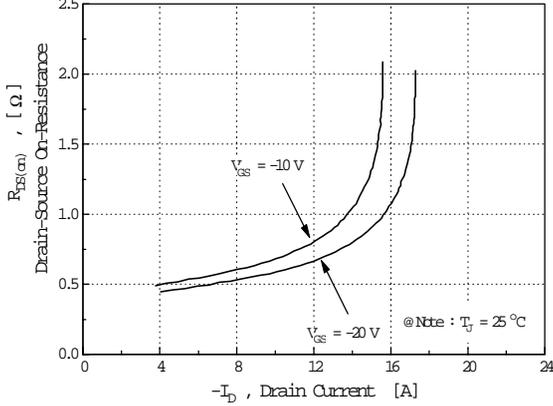
**Fig 1. Output Characteristics**



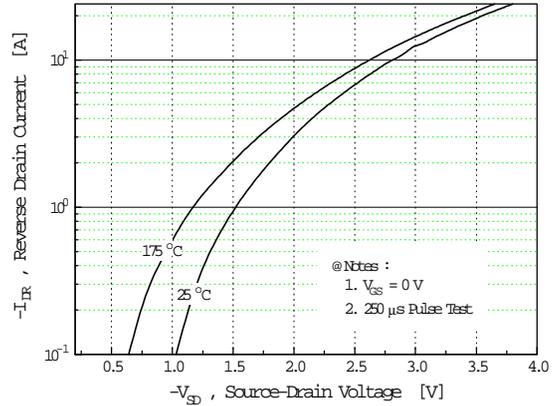
**Fig 2. Transfer Characteristics**



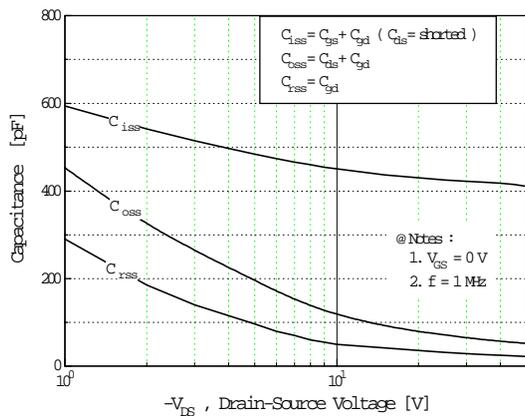
**Fig 3. On-Resistance vs. Drain Current**



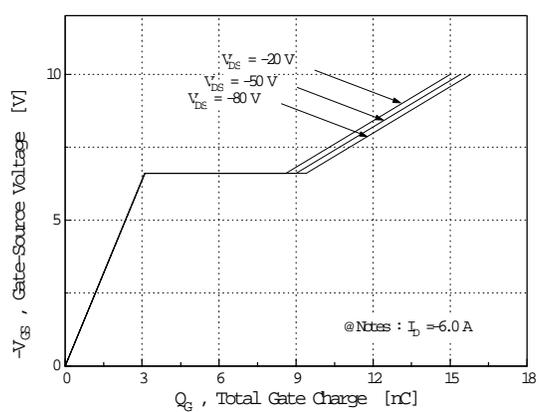
**Fig 4. Source-Drain Diode Forward Voltage**



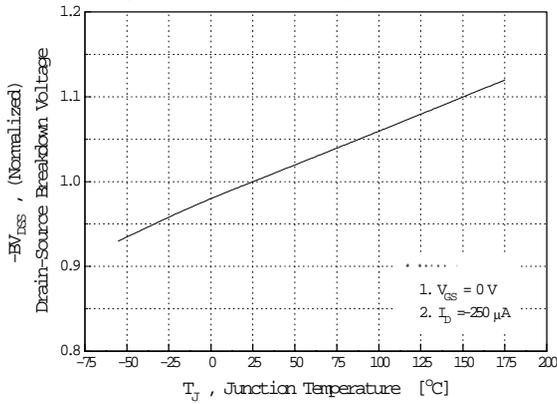
**Fig 5. Capacitance vs. Drain-Source Voltage**



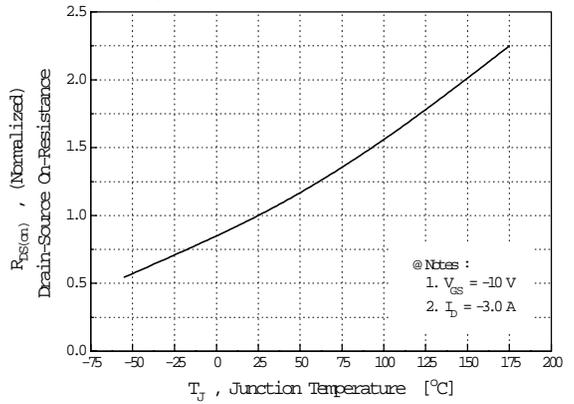
**Fig 6. Gate Charge vs. Gate-Source Voltage**



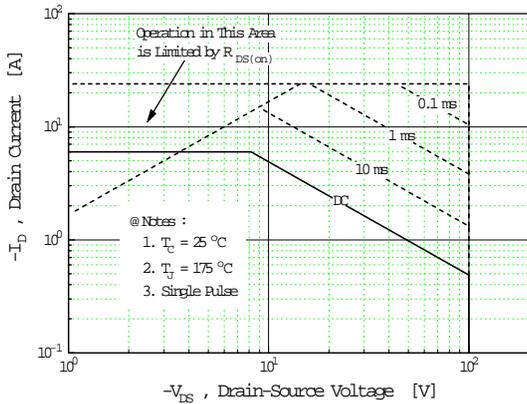
**Fig 7. Breakdown Voltage vs. Temperature**



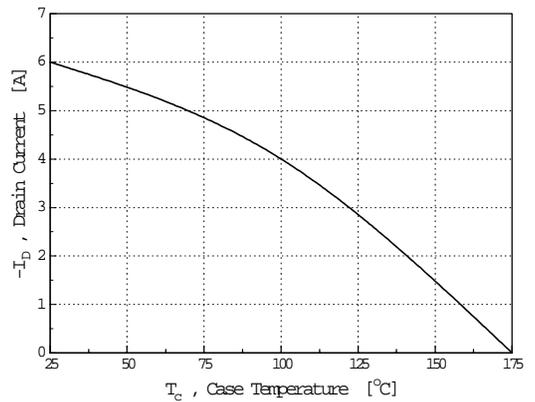
**Fig 8. On-Resistance vs. Temperature**



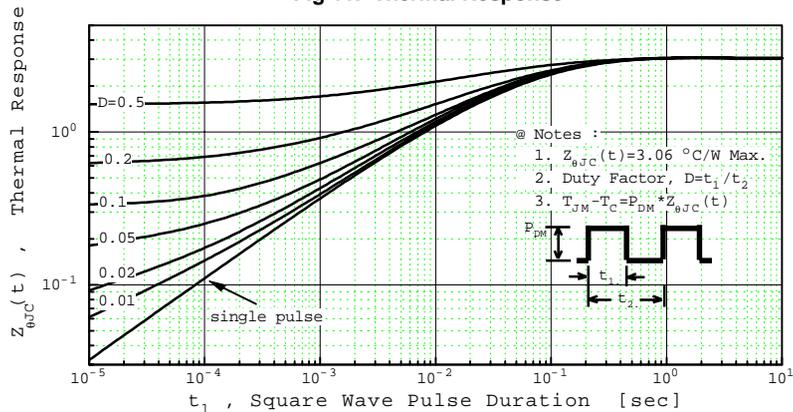
**Fig 9. Max. Safe Operating Area**



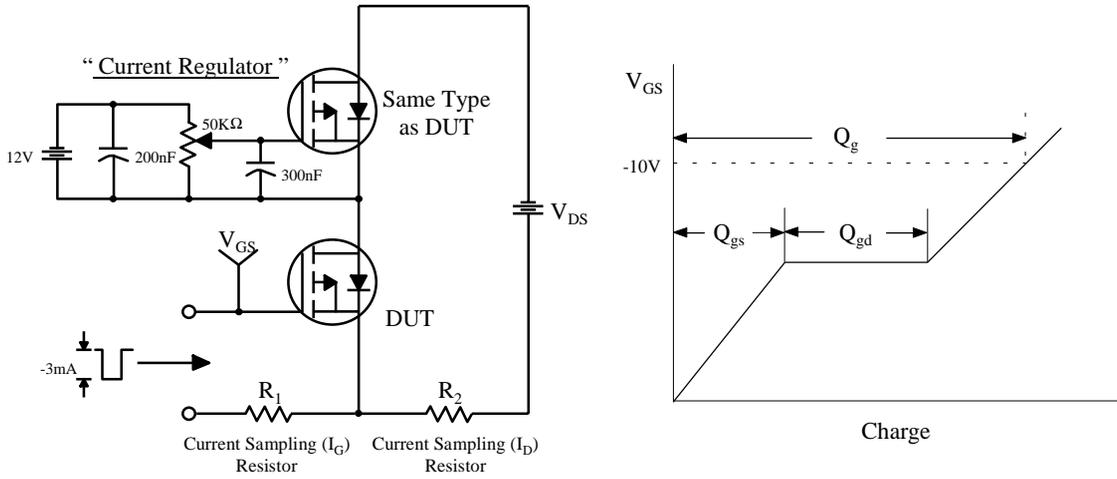
**Fig 10. Max. Drain Current vs. Case Temperature**



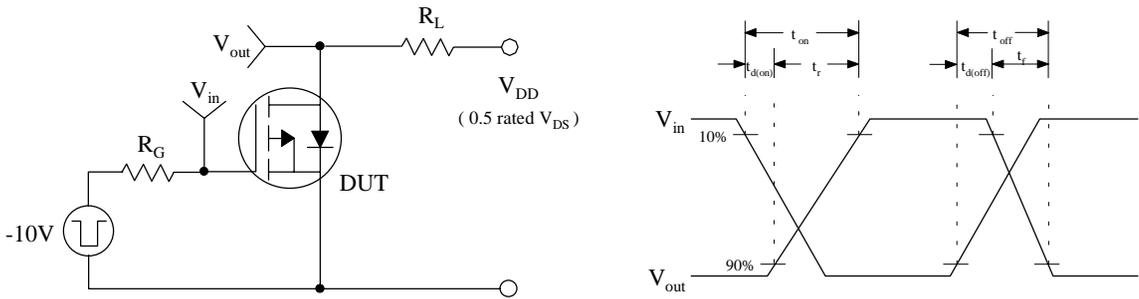
**Fig 11. Thermal Response**



**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

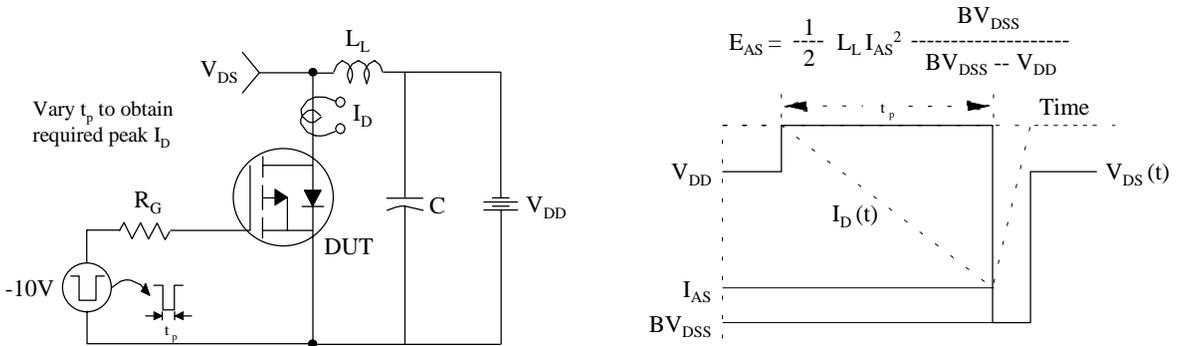
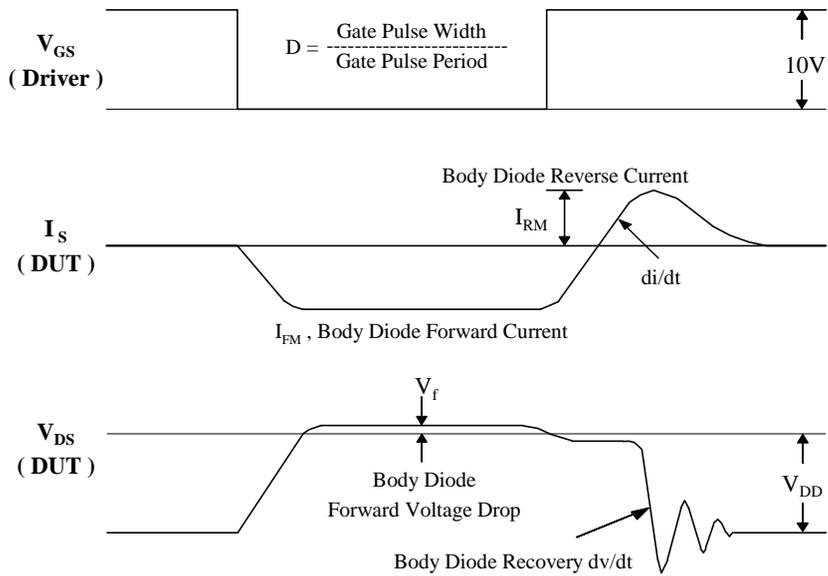
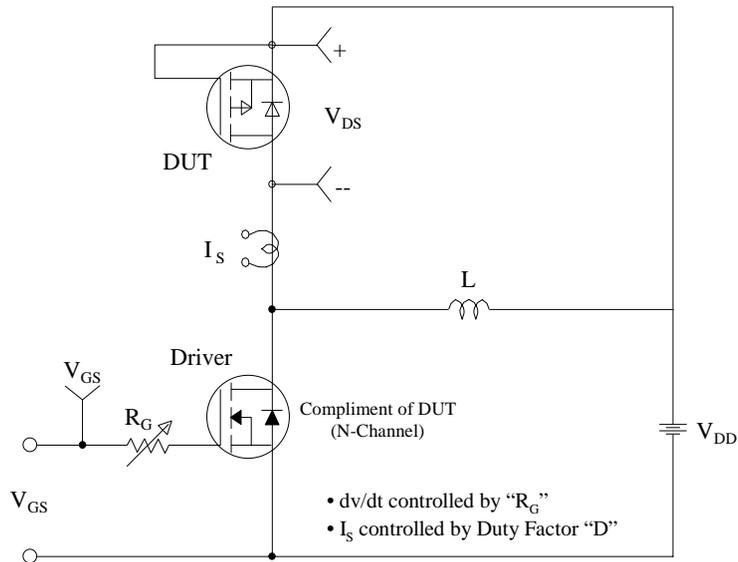


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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